Improving Medication History at Admission Utilizing Pharmacy Students and Technicians: A Pharmacy-Driven Improvement Initiative

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ABSTRACT

Background: Because of the frequency of medication errors related to care transitions, patient-safety initiatives have recently focused on improving the patient medication list. Pharmacy student and technician participation in the medication-history process has been shown to improve the quality of medication histories. To improve patient care, a pharmacy-driven medication-history service utilizing a unique hybrid team of pharmacy students and technicians was launched at Inova Loudoun Hospital (ILH).

Objective: The objective of the service was to improve patient safety and therapy by providing the Best Possible Medication History (BPMH) for admitted acute-care patients.

Methods: Data for the medication-history service was collected for six months from July 2015 to January 2016. The service included pharmacy technicians and fourth-year pharmacy students using the BPMH approach to verify patients' allergies, medications, doses, and frequencies, and to ensure optimal documentation in the Electronic Health Record (EHR). Data on types and numbers of discrepancies and interventions were collected during the process. Readmission rates for the study group were calculated and compared to readmission rates for all patients.

Results: Out of 4,070 patients interviewed, 77.7% (3,162) had at least one discrepancy in their medication list. Per patient, the average number of medications was 7.47, with an average of 1.8 discrepancies. Pharmacy students identified more discrepancies per patient than pharmacy technicians, 2.3 versus 1.5, respectively. Readmission rates for patients interviewed by the medication-history team was lower than for all patients during the same period, as well as for all patients during the same period in the previous year.

Conclusion: This pharmacy-driven medication-history service, staffed with pharmacy technicians and students using a structured BPMH approach, increased the accuracy of home-medication lists on patient admission. The service demonstrated a difference in the types of interventions provided by pharmacy students and technicians. Readmission rates were also lower for patients with completed BPMH.

Keywords: pharmacy students, pharmacy technicians, medication discrepancy, best possible medication history, admission, medication reconciliation, readmission

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INTRODUCTION

Inpatient medication errors are associated with increased patient risks and readmission rates.[1,2] Studies have shown that for 50 to 70% of admitted patients, the initial medication history contains at least one error.[1-3] Errors in the home medication list reviewed during reconciliation upon admission lead to inpatient medication errors and can also propagate errors in the discharge medication list.

In response, hospitals have been encouraged to develop and implement adequate medication reconciliation processes.[4-6] In addition, the World Health Organization (WHO), the Agency for Healthcare Research and Quality, and the Society of Hospital Medicine have promoted a structured method of obtaining the Best Possible Medication History (BPMH) for each patient to decrease errors and improve patient safety.[7-9]

Inova Loudoun Hospital (ILH) is a 189-bed community hospital in Northern Virginia, which admits approximately 13,000 patients per year. In 2015, a pilot medication history program conducted by the ILH pharmacy department found a high rate of discrepancies in the medication histories completed at admission. With an average of nearly four medication discrepancies per medication list, these findings prompted a concerted effort to improve the medication history process. ILH therefore developed and launched a pharmacy-driven medication history program using a structured process to obtain the BPMH for admitted patients.[10]

Pharmacy technicians have been shown to reduce medication list discrepancies as part of various medication reconciliation programs.[11-20] Pharmacy students have demonstrated similar results.[21-32] However, there is less reported evidence regarding the positive benefit that pharmacy students and technicians create while working together to enhance the overall outcomes and efficiency in the medication history process.[33]

METHODS

The ILH pharmacy-driven medication history service consisted of two full-time medication history technicians and two advanced pharmacy practice experience (APPE) medication history students rotating through the service in five-week clinical rotation blocks. The team was trained, supervised, and managed by a clinical pharmacist preceptor. Team members were required to successfully pass a performance-based competency exam (Appendix A) at the end of their training and prior to independently executing the service. In addition, staff pharmacists assisted students in reviewing and cosigning medication history chart notes.

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The focus of the medication history service was on completing the BPMH for adult patients in the emergency department (ED) prior to hospital admission. Patients admitted overnight when the medication history service was not staffed were interviewed the next day whenever possible.

The team was alerted to ED patients awaiting admission through an electronic ED track board within the computer system. Upon notification, a member of the medication history team would begin the BPMH process. During this study, ED triage nurses continued to complete the medication history for all patients registered in the ED. There were no changes to this process as an initial medication history is important for patient assessment and treatment in the ED.

When there were no ED patients awaiting admission, the team members interviewed and collected the BPMH for patients admitted to inpatient units overnight. These patients were located with an electronic list of current admissions by leveraging the electronic health record (EHR) field Prior to Admission (PTA) Medication List Status. ED nurses document "In Progress" for the PTA Medication List Status field after completing an initial patient medication history review. When unit nurses review the home medications, they document "Complete." An additional option, "Pharmacy Complete," was added to this field so that patients interviewed by the pharmacy team could easily be identified.

The pharmacy medication history service was staffed 12 hours a day, seven days per week during the hours of greatest admission volume. Because patients could be admitted and discharged prior to pharmacy review of home medications, it was important to continue with the current process of completing the medication history for patients admitted when the service was not staffed. Therefore, nurses continued the normal medication history-review process during this period and documented the information in the PTA Medication List Status field appropriately.

Prior to each patient interview, the medication history service team members used a paper Medication History Collection Tool (Appendix B) to review and gather pertinent information from the patient's electronic chart and evaluate the current medication list. The team assessed the current medication information for possible discrepancies such as therapeutic and exact duplications; unclear or omitted medications; incorrect medication doses, frequencies, or formulations; and unclear or incorrect free-text medication administration instructions.

The medication history service team employed a patient-centered interview method, which encouraged each patient or caregiver to provide as much information as possible about allergies, medications, and adherence without providing leading cues. During the face-to-face interview, the team member clarified and updated the patient's allergies; the location and contact information for the community or mail-order pharmacies used by the patient; and the name, dosage form, dose, route, frequency, and last dose of all prescriptions, over-the-counter medications, and supplements. Team members attempted to clarify all possible discrepancies noted during the EHR review while at the bedside with the patient. The patient's or caregiver's medication knowledge was evaluated during the interview process using a locally developed and non-validated, five-point medication knowledge scale (Appendix B) to estimate the level of the patient/caregiver's medication knowledge. Team members addressed specific barriers to medication adherence with questions relating to financial concerns, language proficiency, and logistic barriers, including memory or cognitive issues and the patient's ability to obtain necessary medications. They also discussed and documented the currently available and utilized medication-administration memory aids. When necessary, team members communicated any information relating to medication adherence barriers to the hospital case management professionals via a medication history progress note in the EHR, to optimize transitional care services. They also used language services whenever required, including assistance from in-house Spanish interpreters or a telephonic "language-line" for other languages.

Whenever the patient's and/or caregiver's estimated medication knowledge score was less than four or "Knowledgeable," the team members were required to verify the medication list with a secondary source, such as a community pharmacy, family member or caregiver, physician's office, or another HIPPA-appropriate resource. Once the patient interview and any verification were completed, the BPMH was documented in the EHR with all medication history updates as well as additional information collected, such as specific allergic reactions or intolerances to medications and the name and address of the community and mail-order pharmacies used by the patient.

For each patient interviewed, team members documented the following data in a password-protected database: unique patient identifier, date of patient interview, patient location at time of interview (ED or inpatient unit), number of medications on the PTA medication list, type and number of discrepancies, and collecting team member designation (student or technician). Intervention-type data included removal of duplicate medication, addition of omitted medication, removal of discontinued medication, clarification of medication, medication dose, frequency, and route, and missing or incorrect allergy. Members also collected the specific information sources consulted for BPMH verification including patient, family member, pharmacy, physician, insurance company, and other facility.

Discrepancy and information source data were totaled and analyzed. Volume and types of discrepancies were reported as the average number of discrepancies per patient and the percentage of total number of discrepancies for each type, respectively. The frequency of each information source used to complete the BPMH as well as the percentage of interviews that required an external source (phone call) for secondary verification were both reported. Because there were two types of pharmacist extenders used in this service, the volume and type of discrepancies and information sources were evaluated for each group.

Finally, readmission rates were obtained through Premier Network, a quality improvement reporting network, and included all patients admitted through the ED regardless of their inpatient unit.

RESULTS

Data for the medication history service were collected for six months from July 27, 2015 to January 27, 2016. During this period, a total of 4,070 patients were interviewed (Table 1). Of these, 3,162 patients were found to have at least one

Table 1 Medication History Overview	
Study Period: July 27, 2015–January 27, 2016	
Total number of patients interviewed	4,070
Total number of patients with medication discrepancies	3,162
Total number of medication discrepancies	7,284
Average number of medications per patient	7.5
Average number of discrepancies per patient	1.8

Figure 1 Medication History Discrepancy Types

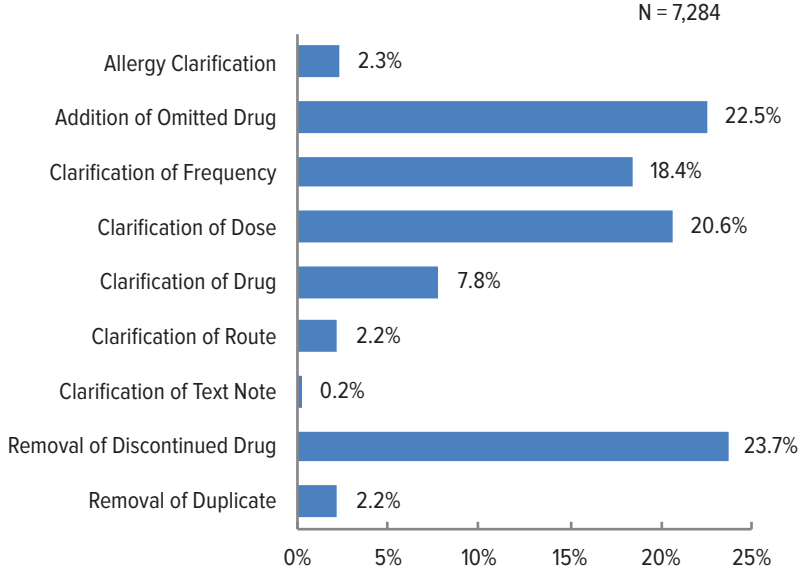
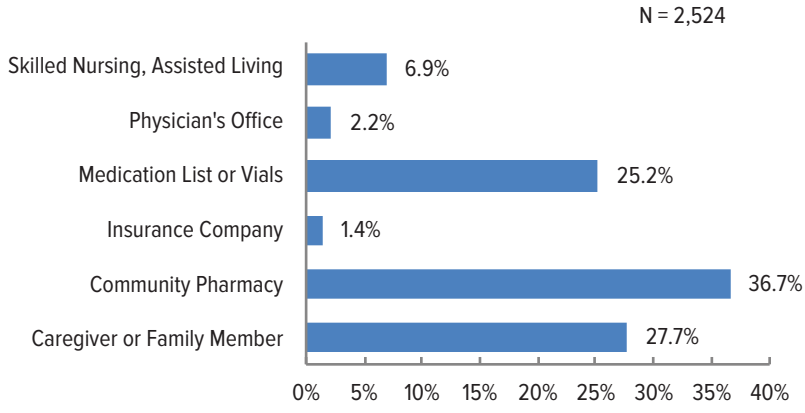


Figure 2 Information Sources Consulted



medication discrepancy in their medication list, with a total of 7,284 discrepancies identified and rectified for all patients. The average number of medications and discrepancies per patient were 7.5 and 1.8, respectively (Table 1).

The most frequent discrepancies identified and rectified were Removal of Discontinued Drug (23.7%) followed by Addition of Omitted Drug (22.5%) and Clarification of Dose (20.6%) [Figure 1]. An additional source of medication information other than the patient or bedside caregiver was necessary for 62% of patients. Of those sources consulted, 68% required a phone call to the patient's community pharmacy, off-site family or caregiver, physician's office, or insurance company (Figure 2).

A comparison regarding the types and volumes of discrepancies documented and the information sources used by the different medication-history team members is provided in Table 2. Overall, pharmacy students documented almost 50% more medication discrepancies per patient than did pharmacy technicians (2.3 and 1.5, respectively). The types of interventions conducted by pharmacy students and pharmacy technicians were similar, with a few notable differences. Pharmacy students added an omitted drug more often than any other intervention, while pharmacy technicians removed a discontinued drug more often. Allergies were more often clarified by pharmacy students, while technicians more often clarified information about a drug and its route. Notably, the percentage of patients interviewed by pharmacy students without any medication discrepancy was much lower than that for pharmacy technicians (12.3% vs. 27.9%, respectively). Pharmacy students contacted external information sources more frequently than did pharmacy technicians and were also more likely to call a physician's office, an insurance company, or a community pharmacy (Table 2).

The all-cause 30-day readmission rate for all hospital patients during the study period was similar to the readmission rate for all hospital patients during the same period in the previous year (10.5% and 11.2%, respectively). However, the all-cause 30-day readmission rate for patients interviewed by the medication history team using the BPMH process was lower (8.9%) (Figure 3).

DISCUSSION

The admission medication-reconciliation process is complicated and has been challenging to streamline. The foundation of this process, the collection of the home medication list, has traditionally been delegated as a nursing responsibility. However, the Joint Commission does not specify which health-care team member should provide this service. Pharmacists,[34-38] pharmacy technicians,[11-20] and pharmacy students[21-31] have all demonstrated improved accuracy in completing the home medication history. This study describes the outcomes of a unique, hybrid medication-history service staffed by pharmacy students who are supervised by a clinical preceptor, alongside full-time, dedicated medication history pharmacy technicians. Judging by the volume of discrepancies rectified in the vast majority of admitted patients, this service improved the accu-

Table 2 Pharmacy Students vs. Technicians Overview

	Total	Students	Technicians
Patients interviewed (%)	4,070 (100)	1,471 (36.1)	2,599 (63.9)
Total discrepancies	7,284	3,392	3,892
Discrepancies per patient	1.8	2.3	1.5
Medication list with no discrepancy (% of patients interviewed)	907 (22.2)	182 (12.3)	725 (27.9)
Discrepancy Types (% of total discrepancies per group)			
Clarification of drug	571 (7.8)	253 (7.5)	318 (8.2)
Clarification of dose	1,503 (20.6)	720 (21.2)	783 (20.1)
Clarification of frequency	1,341 (18.4)	656 (19.3)	685 (17.6)
Clarification of administration route	160 (2.2)	27 (0.8)	133 (3.4)
Clarification of text note	12 (0.2)	11 (0.3)	1 (0)
Removal of discontinued drug	1,727 (23.7)	657 (19.4)	1,070 (27.5)
Removal of duplicate drug	162 (2.2)	67 (2.0)	95 (2.4)
Addition of omitted drug	1,640 (22.5)	839 (24.7)	801 (20.6)
Allergy clarification	168 (2.3)	162 (4.8)	6 (0.2)
Verification Information Sources			
Total number of sources consulted	2,524	1,252	1,272
External sources requiring a phone call (% of total sources consulted per group)	1,715 (67.9)	972 (77.6)	743 (58.4)
Information Source Consulted (% of total sources per group)			
Caregiver or family	700 (27.7)	259 (20.7)	441 (34.7)
Insurance company	34 (1.3)	31 (2.5)	3 (0.2)
Community pharmacy	926 (36.7)	638 (51.0)	288 (22.6)
Physician's office	55 (2.2)	44 (3.5)	11 (0.9)
Medication list or vials	636 (25.2)	189 (15.1)	447 (35.1)
SNF, assisted living, rehab	173 (6.9)	91 (7.3)	82 (6.5)

SNF = Skilled nursing facility

racy of the medication history list at ILH.

This study was not designed to directly assess actual or potential adverse drug events. As a process prior to medication reconciliation, corrections to the medication history were identified and rectified prior to providers' orders whenever possible, thus alleviating potential adverse events. The outcomes reviewed in this study address the basic question of whether a pharmacy-driven medication history service improves the quality of the medication reconciliation process as defined by the volume of interventions necessary to complete the BPMH. An additional outcome was a decrease in readmission rates, which could be related.

The medication-history service team interviewed and completed the BPMH for 4,070 patients, making it one of the largest medication reconciliation studies so far.[39] This study reports a high total volume of admitted patients whose medication lists contained at least one discrepancy, as well as a high volume of discrepancies overall.

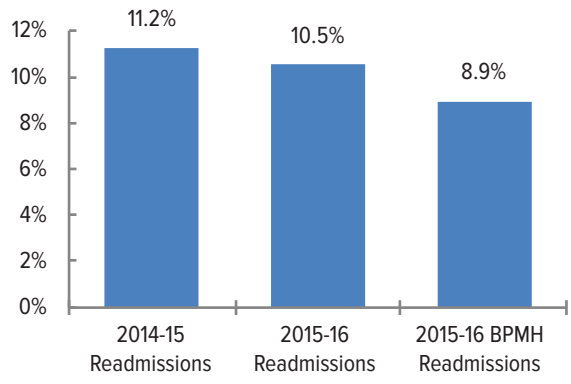
There were minor differences between pharmacy technicians and pharmacy students in the types of medication history discrepancies identified, and larger differences in the percentage of patients who did not require an intervention. The types of secondary sources used to verify information also varied. Pharmacy students identified more discrepancies per patient and more patients with at least one discrepancy than did pharmacy technicians. With a more extensive level of clinical training and knowledge, students may have stronger medication and allergy evaluation skills, thus leading to these differences. Pharmacy students may also be more comfortable communicating with and eliciting information from providers, insurers, and pharmacy personnel judging by the increased frequency of pharmacy student calls to these sources. From a logistical standpoint, pharmacy students were able to provide patient medication adherence and barrier information directly to transitional-care medical and allied health-care professionals as a result of their heightened EHR access and ability to write electronic medication history chart notes. Conversely, technicians were required to call providers to alert them to changes in the patient's medication history list, which is an interruptive process and creates a barrier to providing highly detailed information regarding medication history changes and updates.

Overall, pharmacy technicians were more effective in executing the logistical details of the service, seeing more patients, and clarifying the drug and route as well as removing discontinued and duplicate medications from the list more often. This work complemented the work of students who were involved in more extensive patient interviews, reaching out to providers, and frequently placing phone calls for clarifications. Our medication history service also provided another touchpoint with the health-care team for patients, and provided active and meaningful direct patient-care experiences for pharmacy students and technicians.

The all-cause 30-day readmission rate for patients interviewed by the medication history service was 15% lower than the overall hospital readmission rate for the same period, and 20% lower than the readmission rate for the same period in the previous year, suggesting a positive impact of this medication history service on readmissions.

One limitation of this study was our focus on non–critical-care patients, who may generally have a lower chance of readmission due to lesser acuity. Also, while the medication service ran 12 hours a day, seven days a week, there were times when some target patients were not interviewed because of high

Figure 3 All-Cause 30-Day Readmissions



patient volume and did not have a BPMH completed by the pharmacy team.

A limitation to the hybrid medication history team model was the increased time and energy required for training, coaching, evaluating the competency of, and supervising new students every five weeks. Even though APPE students arrived for the medication history rotation with advanced didactic clinical knowledge, there were barriers to consistency in student competency, including diversity in language abilities, as well as variability in individual skill sets and level of comfort with patient interactions. Therefore, some students required more training and supervision than others. Student medication history chart notes, while highly valued by providers and transitional care services, required a co-signature from a pharmacist and thus a hand-off for each patient.

The two medication history pharmacy technicians, while not as formally educated, were extensively trained, well acquainted with the hospital and medication history process, well known by providers and nurses, and remained consistent throughout the study. Pharmacy technicians were also crucial to sustaining the service when students were unavailable during summer and holiday breaks.

The focus of this medication history service was at the point of patient admission. For the greatest patient safety, the home medication list needs to be evaluated again at discharge to avoid confusion with medication history changes as well as follow-through with interventions identified at admission and during transition of care. Optimizing this pharmacy-driven medication history service could include extending the service window to 24 hours per day and providing additional resources to follow patients and changes in their medications from admission to discharge to ensure optimal medication reconciliation during transitions.

To improve patient safety and therapy by improving the accuracy of the medication history obtained at admission, hospitals should consider leveraging both pharmacy students and pharmacy technicians to assist in the medication history process. Our hybrid medication history service model capitalized on the various benefits of both pharmacy students and pharmacy technicians and demonstrated improved patient care.

CONCLUSION

This pharmacy-driven medication history service, which utilized pharmacy technicians and pharmacy students to provide BPMH for admitted patients, increased the accuracy of patient medication lists over a six-month period. The program demonstrated different but complementary benefits of employing both pharmacy students and pharmacy technicians as medication history team members, and may have had a positive impact on readmission rates.

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Appendix A Medication History Rotation Competency Checklist

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Student: Date(s) of observation:

Medication History Rotation Competency Checklist

Prior to independently participating in the Integrated Medication History Team process and interviewing patients without direct pharmacist supervision, the student will demonstrate competency in the following activities:

Using the Electronic Health Record		Identifies Emergency Department (ED) patients with admission disposition using the ED Track Board
		Uses Patient List to determine patients admitted overnight without BPMH
		Demonstrates understanding of workflow differences between ED patients and admitted patients
Workflow		Uses Epic chart to fill in Medication History Collection Tool demonstrating correct use of: • Patient Banner • Allergy Field • Problem List • Prior to Admission Medications (differentiating between ED and Unit patients) • Current Medications • Physician Notes
Chart Review		Identifies probable and possible allergy and medication discrepancies prior to patient interview
Patient Interview		Acknowledges appropriate patient ID precautions and takes appropriate measures Performs hand hygiene prior to and after every patient interview
		Uses two patient identifiers to ensure correct patient is interviewed Asks if visitors/family should be present for interview
		"Sets the Stage" for a successful interview: • Identifies and addresses communication barriers and special needs • Introduces self by name and title: Pharmacy Technician or Intern • Explains purpose of visit including importance of an accurate and up-to-date medication history • Obtains verbal consent to participate
		Employs a patient-centered communication technique using: • A professional demeanor • Open-ended questions • Prompting only when necessary • Attentive listening • Appropriate volume, speed, and tone to communicate accurate information and empathy
		Obtains specific allergy reactions if necessary
		Obtains medication name, form, dose, route, and frequency
Patient Interview Continued		Obtains OTC and supplement information
		Assesses medication knowledge, compliance, and barriers
		Obtains community pharmacy and physician information

Appendix A Medication History Rotation Competency Checklist (continued)

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		Summarizes information and thanks the patient for his/her time and effort
Clarifications		Uses medication knowledge score to determine which patients need further verification/clarification of their medications and allergies
		Clarifies medication information using outside resources including: • Community pharmacy • Mail-order pharmacy • Physician office • Insurance company • Nursing home Medication Administration Record
		Ensures information is as accurate and up-to-date as possible and double-checked or clarified whenever necessary
Communication with Providers		Professionally communicates medical list clarifications and completeness with providers whenever necessary using SBAR technique
		Communicates with patient's case manager to report any barriers to home medication therapy
Medical History Documentation in EHR		Documents appropriate allergy and medication information in EHR
		Enters the patient's pharmacy and phone number
		Marks medication list "Complete" and notes "Reviewed by Pharmacy"
		Writes an accurate and thorough Student Medication History Note: • Lists specific discrepancies and interventions to medication list • Addresses patient medication knowledge • Lists sources of information
		Documents interventions requiring order change in iVent
Intervention Documentation		Documents interventions on Medication History Collection Tool
		Documents interventions on Medication History Collection Tool
Comments on Student Strengths:		
Comments on Areas of Improvement:		

Preceptor:_____ Date:_____

Appendix B Medication History Collection Tool

MEDICATION HISTORY COLLECTION TOOL

Data collected by: _____ Cosigner Initials:

Date:

Patient Information				
Patient Name			Room	
MRN			Date of Birth	
Admitting MD			Age/Gender	M F
Chief Complaint			Pregnant/Lactating	
Problem List			Language/Hearing	
			Source(s) of Information	Epic

Medication Allergies & Intolerances					
Medication (exact drug name, avoid class)	Description of reaction	Allergy or Intolerance	Date of last reaction	Correction ✔	Source
		A I			
		A I			
		A I			
		A I			

Outpatient Pharmacy Information		
Pharmacy Name	Location (City, Street)	Phone #
Mail Order:		

Patient/Caregiver Medication Knowledge Assessment					
Assess patient's or caregiver's medication knowledge using the following definitions. For any patient whose knowledge is < 4 (1, 2, or 3), consult outside information source.	**5** **Very knowledgeable:** Patient can list all home medications with doses, frequencies, and indications	**4** **Knowledgeable**: Patient can list all medications, most doses, and frequencies; can give indications	**3** **Somewhat Knowledgeable:** Patient can list most medications; may or may not know doses or indications	**2** **Unaware**: Patient can list some medications with or without doses or indications	**1** **Completely Unaware**: Patient cannot list any medications

Compliance/Education Opportunity		Follow Up
Who administers your medications? How? Pill box, from bottles, pill cup?		
On average, how many doses do you miss per week? Why?		
What medications have you recently stopped or started? When? Why?		
What barriers prevent you from taking your medications as prescribed (e.g., time, money)?		

No Discrepancies

Interventions that Required Physician Communication: Please be specific	Physician:		Date and Time:	